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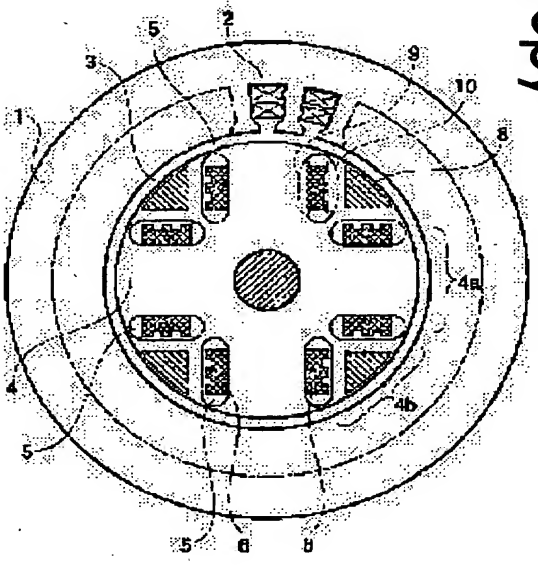
(54) PERMANENT MAGNET RELUCTANCE ROTATING ELECTRIC MACHINE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a permanent magnet reluctance rotating electric machine capable of reducing stress in a rotor core, eliminate the fear of a permanent magnet scattering or a rotor being damaged, and attaining high-speed rotation.
SOLUTION: The permanent magnet 6 is fixed to an inner-periphery surface 9 of a permanent magnet embedding hole 5 by means of magnetic attraction to relieve stress in the rotor core 4 at the time of rotation. The permanent magnet 6 is stably fixed at a position close to a rotating shaft with smaller wall thickness in the core 4 like this to minimize stress in the core 4 with rotation. It is thus possible to provide the permanent magnet reluctance rotating electric machine capable of attaining high reliability, easy manufacturing high- speed rotation, and high output.



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* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] It prepares all over the permanent magnet embedding hole within an iron core so that the magnetic flux of the stator which has an armature coil, and the armature passing through between the magnetic poles which are inside this stator and adjoin each other in a permanent magnet may be negated. In the permanent magnet type reluctance mold dynamo-electric machine which has the rotator which prepared the nonmagnetic section in the permanent magnet periphery side between said magnetic poles, and formed magnetic irregularity in the circumferencial direction and said permanent magnet The permanent magnet type reluctance mold dynamo-electric machine characterized by having intersected perpendicularly in the magnetization direction mostly, having fixed to the wall surface of said permanent magnet embedding hole of an opposite hand with the nonmagnetic section, and preparing a clearance between the wall surfaces by the side of said nonmagnetic section.
[Claim 2] In a permanent magnet type reluctance mold dynamo-electric machine according to claim 1 Said permanent magnet is a permanent magnet type reluctance mold dynamo-electric machine characterized by being fixed to the wall surface of said permanent magnet embedding hole according to the magnetic-attraction force.
[Claim 3] In a permanent magnet type reluctance mold dynamo-electric machine according to claim 2 Said permanent magnet is a permanent magnet type reluctance mold dynamo-electric machine characterized by having a difference among the both ends of the magnetization direction in the magnetic-attraction force between the wall surfaces of said permanent magnet embedding hole, and always fixing one of end faces to the wall surface of said permanent magnet embedding hole.
[Claim 4] In a permanent magnet type reluctance mold dynamo-electric machine according to claim 3 Said permanent magnet is a permanent magnet type reluctance mold dynamo-electric machine characterized by having prepared the level difference in one field of the both ends which counter the wall surface of said permanent magnet embedding hole, and preparing a difference in the magnetic-attraction force in said both ends.
[Claim 5] In a permanent magnet type reluctance mold dynamo-electric machine according to claim 3 Permanent magnet type reluctance mold dynamo-electric machine characterized by having prepared the level difference in one field of the wall surfaces of said permanent magnet embedding hole which counters the both ends of the magnetization direction of said permanent magnet, respectively, and preparing a difference in the magnetic-attraction force of said both ends of said permanent magnet.
[Claim 6] In a permanent magnet type reluctance mold dynamo-electric machine according to claim 3 Permanent magnet type reluctance mold dynamo-electric machine characterized by making the magnetic member which has a level difference placed between the sides which face the wall surface of said permanent magnet embedding hole at either between the wall surfaces of said permanent magnet embedding hole of the magnetization direction of said permanent magnet.
[Claim 7] In a permanent magnet type reluctance mold dynamo-electric machine according to claim 1 Permanent magnet type reluctance mold dynamo-electric machine characterized by infixing elastic members, such as a spring, in either between the wall surfaces of said permanent magnet embedding hole of the magnetization direction of said permanent magnet.
[Claim 8] The permanent magnet type reluctance mold dynamo-electric machine which ****** notching or having been constituted so that it might cut, the elastic section might be formed by lifting processing and said permanent magnet might be pressed by the elastic section in the permanent magnet type reluctance mold dynamo-electric machine of claim 1 to said iron core between said permanent magnet embedding holes and said nonmagnetic sections.
[Claim 9] The permanent magnet type reluctance mold dynamo-electric machine characterized by being set up so that the inside diameter of the iron core of said rotator may become any 1 term of the claims 1-8 in the permanent magnet type reluctance mold dynamo-electric machine of a publication with 25 to 55% of range of the dimension of an iron core.
[Claim 10] The permanent magnet type reluctance mold dynamo-electric machine characterized by setting up the inside diameter of an iron core in a permanent magnet type reluctance mold dynamo-electric machine given in any 1 term of the claims 1-8 so that the stress value of said iron core accompanying the revolution of said rotator may serve as min.
[Claim 11] It prepares all over the permanent magnet embedding hole within an iron core so that the magnetic flux of the stator which has an armature coil, and the armature passing through between the magnetic poles which are inside this stator and adjoin each other in a permanent magnet may be negated. In the permanent magnet type reluctance mold dynamo-electric machine which has the rotator which prepared the nonmagnetic section in the permanent magnet periphery side between said magnetic poles, and formed magnetic irregularity in the circumferencial direction and said permanent magnet The permanent magnet type reluctance mold dynamo-electric machine characterized by being constituted so that the area of the field which carries out an abbreviation rectangular cross with the magnetization direction of said permanent magnet may change along the magnetization direction.
[Claim 12] The permanent magnet type reluctance mold dynamo-electric machine characterized by making the wall surface of said permanent magnet embedding hole deform in a permanent magnet type reluctance mold dynamo-electric machine according to claim 11 so that one edge of said magnetization direction of said permanent magnet may be stopped.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to amelioration of a permanent magnet type reluctance mold dynamo-electric machine.
[0002]
[Description of the Prior Art] Drawing 11 is the direction sectional view of a path showing the conventional permanent magnet type reluctance mold dynamo-electric machine which consists of 4 pole configurations.
[0003] In drawing 11 , a stator 1 has an armature coil 2 and the rotator 3 is formed in the inside. The rotator 3 is equipped with the iron core (rotator) 4 and the permanent magnet 6, a rotor core 4 consists of a laminating configuration of a magnetic steel sheet, and the easy direction of magnetization and the hard direction of magnetization are formed in the circumferencial direction centering on a revolving shaft by turns.
[0004] Eight permanent magnet embedding holes 5 are formed along an easy direction of magnetization in an iron core 4, a permanent magnet 6 is inserted in in the permanent magnet embedding hole 5, and the rotator 3 is being fixed by adhesives, in order to form magnetic irregularity in a peripheral face.
[0005] During a revolution, from the bottom of its heart, towards the direction of a path, an arrangement configuration is carried out and eight permanent magnets 6 form four convex poles (four poles), i.e., magnetic pole section 4a, in the shape of a cross joint.
[0006] Moreover, in drawing 11 , the nonmagnetic section 8 which consists of the cavernous section is formed in the iron core 4 during the medium of the permanent magnet 6 in which the convex pole was formed, i.e., two convex poles, and 4between magnetic poles b is formed in it. That is, the part pinched with each permanent magnet 6 located in the both sides of the nonmagnetic section 8 serves as a crevice magnetically, and the permanent magnet 6 in the permanent magnet embedding hole 5 is magnetized so that the magnetic flux of the armature current which passes along the 4between magnetic poles b may be negated. As for the permanent magnets 6 and 6 of a couple with which the magnetization direction is the same to the circumferencial direction of a rotator 3 with the permanent magnets, and is located in the both sides of 4between magnetic poles b, in the permanent magnets 6 and 6 of the couple located in the both sides of magnetic pole section 4a, all become reversely with reverse mutually [the magnetization direction] to a circumferencial direction. In addition, the permanent magnet 6 is preferably magnetized in the almost vertical direction to the magnetic pole (convex pole) shaft.
[0007] Next, an operation of the conventional permanent magnet type reluctance mold dynamo-electric machine of the above-mentioned configuration is explained.
[0008] Magnetic-flux phid of the component of a direction in alignment with the magnetic pole shaft of the iron core 4 by the armature current of d shaft (part along which the so-called magnetic flux tends to pass) is shown in drawing 12 , in order that magnetic-flux phid may make a magnetic path the iron core 4 of magnetic pole section 4a, its magnetic reluctance is very small and magnetic flux tends to pass along it by the magnetic path of this direction.
[0009] Magnetic-flux phiq of the component of a direction which met the line which connects the center section of 4between magnetic poles b and the core of a rotator 3 by the armature current of q shaft (part along which the so-called magnetic flux cannot pass easily) is shown in drawing 13 , and magnetic-flux phiq forms in it the magnetic path which crosses 4between magnetic poles b in the nonmagnetic section 8 list of a permanent magnet 6. Then, since the relative permeability of the nonmagnetic section 8 which consists of the cavernous section is "1" and the relative permeability of a permanent magnet 6 is also "1" mostly, magnetic-flux phiq by the armature current falls by high magnetic reluctance.
[0010] The magnetic flux generated with each permanent magnets 6 and 6 as each permanent magnets 6 and 6 located in the both sides of magnetic pole section 4a were shown in drawing 14 , since it was magnetized in the almost vertical direction to the magnetic pole shaft as mentioned above flows the magnetic section 7 of the periphery field of an iron core 4 to a circumferencial direction, passes along magnetic pole section 4a, and forms magnetic-circuit phima of the path which returns to the pole of self objection. this -- the time -- each -- a permanent magnet -- six -- six -- a part -- magnetic flux -- an opening (air gap section between so-called stators 1 and rotators 3) -- pass -- a stator 1 -- a passage -- mutual -- magnetic pole section 4a of the next permanent magnet 6 and a rotator 3 -- a passage -- the original magnetic-circuit phimb which returns to a permanent magnet 6 -- forming .
[0011] As shown in drawing 13 , the flux linkage of a permanent magnet 6 is distributed over hard flow, is ****ed to armature magnetic-flux phiq which invades from 4between magnetic poles b, and is denied magnetic-flux phiq of the direction component of a medial axis of 4between magnetic poles b by the armature current of q shaft mutually.
[0012] Therefore, in the air gap section of the outside of 4between magnetic poles b, the flux density of the air gap which the armature current makes by the magnetic flux of a permanent magnet 6 is reduced again, and a big change (difference) is presented as compared with the air gap flux density on magnetic pole section 4a. Consequently, change of the air gap flux density to the location of a rotator 3, i.e., a big magnetic energy change, is obtained.
[0013] Furthermore, it has the magnetic section 7 magnetically short-circuited in the border area of magnetic pole section 4a and 4between magnetic poles b at the time of a load, and magnetic saturation of the magnetic section 7 is greatly carried out according to the load current. Consequently, the magnetic flux of the permanent magnet 6 distributed over 4between magnetic poles b increases, the large irregularity of air gap flux density distribution, i.e., magnetic energy change, is formed of the high magnetic reluctance in the nonmagnetic section 8 and a permanent magnet 6, and the magnetic flux of a permanent magnet 6, and high power is drawn from a dynamo-electric machine.

[0014] In addition, since a permanent magnet 6 keeps spacing in the circumferencial direction of a rotator 3 at a permanent magnet type reluctance mold dynamo-electric machine and it is arranged, as compared with the so-called common permanent-magnet type dynamo-electric machine of the outside circumferencial direction of a rotator 3 which has arranged the rear-spring-supporter permanent magnet 6 in the perimeter enclosure mostly, the surface area of permanent magnet 6 the very thing is small, and there are also few amounts of flux linkages by the permanent magnet 6.
[0015] Moreover, in a permanent magnet type reluctance mold dynamo-electric machine, almost all the magnetic flux of the permanent magnet 6 in a deenergisation condition turns into leakage flux within the rotor core 4 which passes along the magnetic section 7. Therefore, since induced voltage can be made very small in this condition, the iron loss at the time of deenergisation decreases. Moreover, there is also little overcurrent which flows when an armature coil 2 carries out closed-circuit failure.
[0016] Moreover, in the time of a load, the flux linkage by the armature current (the excitation current component and torque current component of a reluctance mold dynamo-electric machine) joins the flux linkage by the permanent magnet 6, and a permanent magnet type reluctance mold dynamo-electric machine guides terminal voltage to it.
[0017] On the other hand, in a common permanent-magnet type dynamo-electric machine, since the flux linkage of a permanent magnet 6 occupies most terminal voltage, it is difficult to adjust terminal voltage, but since there are few flux linkages by the permanent magnet 6, a permanent magnet type reluctance mold dynamo-electric machine has the description which can adjust terminal voltage broadly by adjusting an excitation current component widely.
[0018] That is, a permanent magnet type reluctance mold dynamo-electric machine can adjust an excitation current component so that an electrical potential difference may become below supply voltage according to rotational speed, and wide range adjustable-speed operation of it is attained from base speed on a fixed electrical potential difference. An overvoltage seems moreover, not to generate, even if control stops operating at the time of a high-speed revolution since a field weakening is performed by compulsory control and the electrical potential difference is not controlled.
[0019] Since the permanent magnet type reluctance mold dynamo-electric machine has composition which embeds a permanent magnet 6 in a rotor core 4, iron core 4 of the magnetic steel sheet which consists of a laminated structure itself becomes the maintenance device of a permanent magnet 6, and scattering of the permanent magnet 6 by the rotational centrifugal force etc. is prevented further again.
[0020] Moreover, in the above-mentioned conventional permanent magnet type reluctance mold dynamo-electric machine, as shown in drawing 15 , in order that magnetic-flux phiq by q shaft current to the rotator 3 which the armature current shown in drawing 13 forms may flow the periphery side thin-walled part 18 of the permanent magnet embedding hole 5, and the bridge thin-walled part 19 of the revolution medial-axis approach of 4between magnetic poles b, the difference of magnetic-flux phid by d shaft current and magnetic-flux phiq by q shaft current becomes small, and reluctance torque decreases.
[0021] Then, in order that magnetic-flux phiq by q shaft current invalid to running torque may make small the leakage of the magnetic flux which lessens invalid magnetic flux which flows from the periphery side of the nonmagnetic section 8 to the periphery side thin-walled part 18 of the permanent magnet embedding hole 5, and is generated from a permanent magnet 6 (permanent magnet invalid magnetic flux 17), the permanent magnet embedding hole 5 circumference [of an iron core 4] and periphery side of 4between magnetic poles b can consider narrowing in the direction of a path as much as possible.
[0022]
[Problem(s) to be Solved by the Invention] However, in the above-mentioned conventional permanent magnet type reluctance mold dynamo-electric machine, when the permanent magnet embedding hole 5 circumference and periphery side of 4between magnetic poles b was made narrow in the direction of a path, it tends to become difficult to support the centrifugal force of permanent magnet 6 the very thing by revolution in reinforcement in a rotor core 4 and it tends to apply to especially a high-speed rotating machine, scattering of a permanent magnet 6 and breakage of a rotator 3 arise, and the formation as a dynamo-electric machine comes to be hard.
[0023] Moreover, although also making the amount of a permanent magnet 6 increase is considered in order to compensate the amount of magnetic flux of invalid magnetic flux and leakage flux with the conventional permanent magnet type reluctance mold dynamo-electric machine and to secure required effective magnetic flux on a property Since the problem on the tooth space that the rate of the volume which the permanent magnet embedding hole 5 to the volume of the rotator 3 whole occupies becomes large, and the stress of the permanent magnet 6 by the centrifugal force increase further, it is a reinforcement top problem and it is difficult for a structure top list to make the amount of a permanent magnet 6 increase simply.
[0024] Moreover, although the permanent magnet 6 was conventionally fixed to the permanent magnet embedding hole 5 by adhesives, adhesive strength declines by degradation of adhesives etc. and there is also a possibility of dropping out with a permanent magnet 6 in the permanent magnet embedding hole 5. according to the centrifugal force accompanying the revolution of a rotator 3 in the permanent magnet 6 which was omitted in the permanent magnet embedding hole 5, since the near wall by the side of the periphery of the permanent magnet embedding hole 5 (i.e., the one more distant than a revolving shaft) is pressed, it will lead to the increment in the stress to the periphery side thin-walled part 18 of the permanent magnet embedding hole 5 supporting 4between magnetic poles b periphery side, and the central-site bridge thin-walled part 19 of 4between magnetic poles b.
[0025] Therefore, if it is going to apply the rotator of the above-mentioned configuration to the dynamo-electric machine of a high-speed revolution and high power, the periphery side thin-walled part 18 and the central-site bridge thin-walled part 19 will receive breakage according to the centrifugal force which increased, and we will be anxious about scattering of a permanent magnet 6, breakage of a rotator 3, etc.
[0026] Moreover, since the configuration has isotropy to the magnetization direction and, as for the permanent magnet 6 in the conventional permanent magnet type reluctance mold dynamo-electric machine, did not have directivity, the magnetization direction of a permanent magnet 6 was not visually discriminable, authorized personnel might be mistaken in the direction at the time of the assembly operation of a rotator 3, the permanent magnet 6 might be inserted, and the improvement was demanded.
[0027]
[Means for Solving the Problem] There is invention according to claim 1 inside the stator which has an armature coil, and this stator. It prepares all over the embedding hole of the permanent magnet within an iron core so that the magnetic flux of the armature passing through between the magnetic poles which adjoin each other in a permanent

magnet may be negated. In the permanent magnet type reluctance mold dynamo-electric machine which has the rotator which prepared the nonmagnetic section in the permanent magnet periphery side between said magnetic poles, and formed magnetic irregularity in the hoop direction and a permanent magnet It is characterized by having intersected perpendicularly in the magnetization direction mostly, having fixed to the wall surface of said permanent magnet embedding hole of an opposite hand with the nonmagnetic section, and preparing a clearance between the wall surfaces by the side of said nonmagnetic section.
[0028] Invention according to claim 2 is characterized by a permanent magnet being fixed to the wall surface of an embedding hole by the magnetic-attraction force of a permanent magnet in a permanent magnet type reluctance mold dynamo-electric machine according to claim 1.
[0029] In a permanent magnet type reluctance mold dynamo-electric machine according to claim 2, a permanent magnet has a difference among the both ends of the magnetization direction in the magnetic-attraction force between the wall surfaces of a permanent magnet embedding hole, and invention according to claim 3 is always characterized by fixing one of end faces to the wall surface of a permanent magnet embedding hole.
[0030] Thus, according to each invention according to claim 3 from claim 1, with the nonmagnetic section, since it is fixed to the wall surface of the permanent magnet embedding hole of an opposite hand and the centrifugal force of the permanent magnet accompanying the revolution of a rotator does not join the structurally weak nonmagnetic section, a permanent magnet can avoid breakage of a rotator, and scattering to the outside of a permanent magnet.
[0031] It is characterized by for invention according to claim 4 or 5 having prepared the level difference in one field of the both ends of the magnetization direction where a permanent magnet counters the wall surface of a permanent magnet embedding hole, or one field of the wall surfaces of the permanent magnet embedding hole which counters the both ends of the magnetization direction of a permanent magnet, respectively in the permanent magnet type reluctance mold dynamo-electric machine according to claim 3, and preparing a difference in the magnetic-attraction force of the both ends of a permanent magnet.
[0032] Thus, since according to invention according to claim 4 or 5 the level difference was formed and the difference was prepared in the magnetic-attraction force, breakage of a rotator and scattering to the outside of a permanent magnet are avoidable like an operation of invention according to claim 3.
[0033] Invention according to claim 6 is characterized by making the magnetic member which prepared the level difference in the side which faces the wall surface of a permanent magnet embedding hole at either between the wall surfaces of the permanent magnet embedding hole of the magnetization direction of a permanent magnet intervene in a permanent magnet type reluctance mold dynamo-electric machine according to claim 3.
[0034] Thus, according to invention according to claim 6, since the magnetic member was made to intervene, in addition to an operation of invention according to claim 3, immobilization of a permanent magnet is performed more firmly.
[0035] In a permanent magnet type reluctance mold dynamo-electric machine according to claim 1, to either between the wall surfaces of the permanent magnet embedding hole of the magnetization direction of a permanent magnet, it cuts, the elastic section is formed by lifting processing, and invention according to claim 7 or 8 ****** notching or having constituted so that a permanent magnet might be pressed in infixation of elastic members, such as a spring, or the iron core between a permanent magnet embedding hole and the nonmagnetic section.
[0036] Thus, according to invention according to claim 7 or 8, in addition to an operation of invention according to claim 1, a permanent magnet is more firmly fixed by the configuration of an elastic member or the elastic section.
[0037] In a permanent magnet type reluctance mold dynamo-electric machine given in any 1 term of the claims 1-8, invention according to claim 9 or 10 sets up the inside diameter of an iron core, and is characterized by things so that the stress value of 25 to 55% of range of the dimension of an iron core or the iron core accompanying the revolution of a rotator may serve as min in the inside diameter of the iron core of a rotator.
[0038] Thus, invention according to claim 9 or 10 Since the inside diameter of an iron core is set up so that the stress value of 25 to 55% of range of the dimension of an iron core or the iron core accompanying the revolution of a rotator may serve as min in the inside diameter of the iron core of a rotator, and it was made for the stress accompanying the revolution of the rotator itself to serve as min In addition to the operation in each invention of claims 1-8, a firm rotator can be offered more mechanically.
[0039] There is invention according to claim 11 inside the stator which has an armature coil, and this stator. It prepares all over the permanent magnet embedding hole within an iron core so that the magnetic flux of the armature passing through between the magnetic poles which adjoin each other in a permanent magnet may be negated. In the permanent magnet type reluctance mold dynamo-electric machine which has the rotator which prepared the nonmagnetic section in the permanent magnet periphery side between said magnetic poles, and formed magnetic irregularity in the circumferencial direction and a permanent magnet It is characterized by being constituted so that the area of the field which carries out an abbreviation rectangular cross with the magnetization direction of a permanent magnet may change along the magnetization direction.
[0040] Invention according to claim 12 is characterized by making the wall surface of a permanent magnet embedding hole deform so that one edge of the magnetization direction of a permanent magnet may be stopped in a permanent magnet type reluctance mold dynamo-electric machine according to claim 11.
[0041] As mentioned above, since according to invention given in claims 11 and 12 the configuration of a permanent magnet was changed in the magnetization direction and directivity was given, on the occasion of assembly manufacture of a rotator, authorized personnel cannot be mistaken in the inclusion direction of a permanent magnet, and can work efficiently.
[0042]
[Embodiment of the Invention] Hereafter, the gestalt of 1 operation of the permanent magnet type reluctance mold dynamo-electric machine of this invention is explained to a detail with reference to drawing 1 thru/or drawing 10 . In addition, the same sign is given to the same configuration as the conventional configuration shown in drawing 11 thru/or drawing 15 , and detailed explanation is omitted.
[0043] (The gestalt of the 1st operation: Correspond to claims 1, 2, 3, and 4)
(Configuration) Drawing 1 is the direction sectional view of a path showing the gestalt of operation of the 1st of the permanent magnet type reluctance mold dynamo-electric machine of this invention. Moreover, drawing 2 is the direction expanded sectional view of a path of the rotator shown in drawing 1 .
[0044] In drawing 1 , a stator 1 has an armature coil 2 and, inside, the rotator 3 which consists of a laminating configuration of a magnetic steel sheet is held. The rotator 3 is equipped with the rotor core 4 and the permanent

magnet 6, and the rotor core 4 forms the easy direction of magnetization (d shaft orientations) and the hard direction of magnetization (q shaft orientations).
[0045] In order that a rotor core 4 may form magnetic irregularity in a circumferencial direction, eight permanent magnet embedding holes 5 are formed along an easy direction of magnetization, and it is equipped with the permanent magnet 6 in the permanent magnet embedding hole 5.
[0046] The permanent magnets 6 and 6 which the nonmagnetic section 8 which consists of a cavity (opening) forms a crevice (4between magnetic poles b) in magnetic pole, and are located in the both sides are magnetized so that the magnetic flux of the armature current which passes along 4between magnetic poles b may be negated.
[0047] On the other hand, the permanent magnets 6 and 6 of the couple (two pieces) located in the both sides of magnetic pole section 4a have the same magnetization direction, and, in the magnetization direction, two permanent magnets 6 and 6 located in the both sides of 4between magnetic poles b serve as reverse mutually along with the circumferencial direction of a rotator 3. In addition, as for a permanent magnet 6, it is desirable to be magnetized in the direction almost vertical to a magnetic pole (convex pole) shaft.
[0048] As shown in drawing 2 , a permanent magnet 6 is in the permanent magnet embedding hole 5, and adhesion immobilization is carried out by the magnetic-attraction force of self [the field which intersects perpendicularly with the near inner circumference side-attachment-wall side 9 mostly with the magnetization direction with the revolving shaft of an opposite hand] in the nonmagnetic section 8.
[0049] And between further periphery side-attachment-wall sides 10 and permanent magnets 6, the clearance (space) is prepared from the inner circumference side-attachment-wall side of an opposite hand (namely, the nonmagnetic section 8 side), i.e., a revolving shaft, in the inner circumference side-attachment-wall side 9 where the permanent magnet 6 was fixed. In addition, the explanatory view below drawing 1 shall surround and show the applicable partial location of the inner circumference side-attachment-wall side 9 of the permanent magnet embedding hole 5 corresponding to the ends side of the magnetization direction of a permanent magnet 6, and the periphery side-attachment-wall side 10 with a broken line.
[0050] Then, as shown in drawing 2 , the step (irregularity) is formed in the 6th page of the permanent magnet of the side which counters the periphery side-attachment-wall side 10 of the ********** lump hole 5, and it is constituted so that the surface area of the part which counters about ten periphery side-attachment-wall side may become small by the heights of a step. in addition -- although the level difference was prepared with the gestalt of this operation so that a permanent magnet 6 might meet radially and irregularity (step) might stand in a row -- radially -- meeting -- coming out -- there is nothing, and a level difference can also be prepared so that irregularity (step) may stand in a row in accordance with the shaft orientations of a rotator 3.
[0051] (Operation) The permanent magnet type reluctance mold dynamo-electric machine of the gestalt of the 1st operation is different from the former, the permanent magnet 6 is being fixed to the inner circumference side-attachment-wall side 9 of the permanent magnet embedding hole 5, and since it is more close to a revolving-shaft side, the average centrifugal force of permanent magnet 6 the very thing accompanying the revolution of the rotator 3 of a permanent magnet 6 will be able to become smaller, and can make the stress to a rotor core 4 mitigate in this way.
[0052] Therefore, although each of the periphery side thin-walled part 18 of the permanent magnet embedding hole 5 supporting the periphery side of a rotator 3 and the magnetic pole period ** side bridge thin-walled part 19 is in the situation that thickness is thin and severe in reinforcement, permanent magnet 6 the very thing is being fixed to the thick inner circumference side-attachment-wall side 9 in the permanent magnet embedding hole 5, and the stress concerning the periphery side thin-walled part 18 accompanying the revolution of a rotator 3 or the bridge thin-walled part 19 is mitigated.
[0053] Moreover, since it is fixed to the inner circumference side-attachment-wall side 9 of the permanent magnet embedding hole 5 by the magnetic-attraction force of self, the adhesives by secular change wither like before and a permanent magnet 6 does not have peeling by ****** etc., a permanent magnet 6 is in the permanent magnet embedding hole 5, and is stabilized by it.
[0054] With the gestalt of this operation, since irregularity is prepared in the field which a permanent magnet 6 forms an opening in the periphery side-attachment-wall side 10 of the ********** lump hole 5, and counters, the magnetic flux which passes along the heights of that permanent magnet 6 according to the periphery side-attachment-wall side 10 since the surface area (namely, head area of heights) of a near part is small decreases further again. Consequently, as for the magnetic-attraction force of a permanent magnet 6 over the circumferential side-attachment-wall side of the ********** lump hole 5, the magnetic-attraction force between the inner circumference side-attachment-wall sides 9 becomes stronger than the magnetic-attraction force between the periphery side-attachment-wall sides 10, and a permanent magnet 6 is firmly fixed in the magnetization direction by the inner circumference side-attachment-wall side 9.
[0055] According to the permanent magnet type reluctance mold dynamo-electric machine of the gestalt of the 1st operation shown in drawing 1 and 2, a permanent magnet 6 (Effectiveness) As mentioned above, in the permanent magnet embedding hole 5 (Average) Since a centrifugal force is fixed to the thick inner circumference side-attachment-wall side 9 smaller moreover, while being able to reduce the stress exerted on a rotor core 4, avoiding breakage on a rotator 3 and raising dependability, buildup of a more nearly high-speed revolution and an output is realizable.
[0056] Moreover, since the permanent magnet 6 formed irregularity (level difference) in the front face of the side which counters the periphery side-attachment-wall side 10 of the permanent magnet embedding hole 5 through a gap, strength can attach it further according to the magnetic-attraction force committed to magnetization direction each field of a permanent magnet 6 and the permanent magnet embedding hole 5, and it can make firmer immobilization in the inner circumference side-attachment-wall side 9 of the permanent magnet embedding hole 5 according to the difference of the suction force.
[0057] furthermore -- since the magnetic-attraction force of self is fixed in the permanent magnet embedding hole 5 and a permanent magnet 6 does not use adhesives like before with the gestalt of this operation, while adhesives wither, and there are no omission by ****** and being stabilized -- mounting into the iron core 4 of a permanent magnet 6 is easy -- becoming -- the increase in efficiency of manufacture -- drawing -- things are made.
[0058] (The gestalt of the 2nd operation: Correspond to claim 5)
(Configuration) Drawing 3 is the direction expanded sectional view of a path of a rotator showing the gestalt of operation of the 2nd of the permanent magnet type reluctance mold dynamo-electric machine of this invention.

[0059] As shown in drawing 3 , a level difference (irregularity) is constituted from a gestalt of this operation by periphery side-attachment-wall side 10 the very thing by the side of the nonmagnetic section 8 among the wall surfaces of the permanent magnet embedding hole 5 which counters in the both ends of the magnetization direction of a permanent magnet 6, respectively, and it forms so that this may have a difference in the magnetic-attraction force in the both ends of a permanent magnet 6.
[0060] Also by this configuration, therefore, between a permanent magnet 6 and the periphery side-attachment-wall side 10 of the permanent magnet embedding hole 5 Since the surface area (namely, head area of heights) of the part which approaches the periphery side-attachment-wall side 10 by the heights of a permanent magnet 6 in addition to having a gap is small Strength takes lessons from the magnetic-attraction force committed in the magnetization direction of a permanent magnet 6 as well as the gestalt of the 1st operation, and a permanent magnet 6 is firmly fixed to the inner circumference side-attachment-wall side 9 side of the permanent magnet embedding hole 5 by the difference of the suction force.
[0061] In addition, in the gestalt of this operation, although the rotor core 4 met radially and the level difference (irregularity) is prepared, in accordance with the shaft orientations of a rotor core 4, a level difference (irregularity) may be prepared like the gestalt of the 1st operation.
[0062] (Operation) In this way, since the permanent magnet type reluctance mold dynamo-electric machine of the gestalt of the 2nd operation formed the level difference in the periphery side-attachment-wall side 10 of the permanent magnet embedding hole 5, the magnetic flux passing through a permanent magnet 6 and the periphery side-attachment-wall side 10 decreases, and becomes smaller than the magnetic-attraction force between the inner circumference side-attachment-wall sides 9 of an opposite hand, and a permanent magnet 6 is firmly fixed to the inner circumference side-attachment-wall side 9 of the smaller direction of a centrifugal force.
[0063] (Effectiveness) As mentioned above, according to the permanent magnet type reluctance mold dynamo-electric machine of the gestalt of the 2nd operation, a permanent magnet 6 is firmly fixable to the inner circumference side-attachment-wall side 9 of the permanent magnet embedding hole 5 by [which are shown in drawing 3] having formed the level difference (irregularity) in the periphery side-attachment-wall side [of the permanent magnet embedding hole 5] 10 4, i.e., rotor core, side.
[0064] therefore, also in the gestalt of this operation, since it is moreover fixed to the inner circumference side-attachment-wall side 9 by the side of thickness and a permanent magnet 6 can reduce near and the stress to a rotor core 4 by the revolving-shaft side of the permanent magnet embedding hole 5, while being able to avoid breakage for a rotator 3 and being able to raise dependability, rotational speed can realize the large permanent magnet type reluctance mold dynamo-electric machine of early and an output more.
[0065] Moreover, since the magnetic-attraction force of self is fixed in the permanent magnet embedding hole 5, a permanent magnet 6 is stabilized by immobilization, and since a permanent magnet 6 has an easy configuration and structure, it becomes easy to manufacture [of a rotator 3] it.
[0066] (The gestalt of the 3rd operation: Correspond to claim 6)
(Configuration) Drawing 4 is the direction expanded sectional view of a path of a rotator showing the gestalt of operation of the 3rd of the permanent magnet type reluctance mold dynamo-electric machine of this invention.
[0067] That is, with the gestalt of this operation, a permanent magnet 6 is fixed through the magnetic member 11 between the inner circumference side-attachment-wall sides 9 of the permanent magnet embedding hole 5, and the magnetic member 11 prepares a cross-section KO character-like level difference (irregularity) in the field of the side which touches the inner circumference side-attachment-wall side 9 like a graphic display.
[0068] And like the gestalt of the 1st and the 2nd operation, since the clearance was formed between the permanent magnet 6 and the periphery side-attachment-wall side 10 of the permanent magnet embedding hole 5, a permanent magnet 6 is firmly fixed to the inner circumference side-attachment-wall side 9 of the permanent magnet embedding hole 5 by the magnetic-attraction force through the magnetic member 11. In addition, with the gestalt of this operation, the magnetic member 11 may prepare the level difference (irregularity) of the magnetic member 11 along the direction of a revolving shaft of a rotator 3, although it has illustrated so that it may meet radially and a level difference (irregularity) may be prepared.
[0069] (Operation) Since according to the permanent magnet type reluctance mold dynamo-electric machine of the gestalt of the 3rd operation the permanent magnet 6 is being fixed in the magnetization direction by the inner circumference side-attachment-wall side 9 through the magnetic member 11 and the inner circumference side-attachment-wall side 9 side of the magnetic member 11 moreover has a level difference, almost all the magnetic flux by the above-mentioned configuration generated from a permanent magnet 6 reaches in a rotor core 4 through the magnetic member 11. Therefore, the flux density between the heights of the magnetic member 11 with the small edge cross section and the inner circumference side-attachment-wall side 9 of the permanent magnet embedding hole 5 also increases the large next door magnetic-attraction force, and a permanent magnet 6 is firmly fixed to the inner circumference side-attachment-wall side 9 of the permanent magnet embedding hole 5 through the magnetic member 11.
[0070] (Effectiveness) As mentioned above, since according to the permanent magnet type reluctance mold dynamo-electric machine of the gestalt of the 3rd operation it is firmly fixed to a rotor core 4 through the magnetic member 11 and a permanent magnet 6 is stabilized, like the gestalt of the 1st and the 2nd operation, it has high-reliability and the dynamo-electric machine of a high-speed revolution and high power can be offered.
[0071] (The gestalt of the 4th operation: Correspond to claim 7)
(Configuration) Drawing 5 is the direction expanded sectional view of a path of a rotator showing the gestalt of operation of the 4th of the permanent magnet type reluctance mold dynamo-electric machine by this invention.
[0072] As shown in drawing 5 , between a permanent magnet 6 and the periphery side-attachment-wall side 10 of the permanent magnet embedding hole 5, the elastic members 12, such as a spring, are inserted so that the energization direction of the elastic force may be in agreement with the magnetization direction of a permanent magnet 6, an elastic member 12 presses a permanent magnet 6, and the rotator 3 of the gestalt of this operation is constituted so that press immobilization of the permanent magnet 6 may always be carried out firmly in the inner circumference side-attachment-wall side 9 of the permanent magnet embedding hole 5.
[0073] In addition, with the gestalt of this operation, although array insertion of the two elastic members 12 was carried out along the direction of a path of a rotator 3, one piece or three plurality or more are sufficient as the number of an elastic member 12. Moreover, array insertion also of the array direction of two or more elastic members 12 can be carried out not only along the direction of a path of a rotator 3 but along the direction of a revolving shaft.

[0074] (Operation) as mentioned above -- the permanent magnet type reluctance mold dynamo-electric machine of the gestalt of this operation -- a permanent magnet 6 -- the self-magnetic-attraction force -- in addition, since it is pushed against the inner circumference side-attachment-wall side 9 of the permanent magnet embedding hole 5 by the elastic members 12, such as a spring, a permanent magnet 6 is fixed certainly and firmly to the inner circumference side-attachment-wall side 9 of the permanent magnet embedding hole 5 by them.
[0075] (Effectiveness) since a permanent magnet 6 pushes a permanent magnet 6 against the inner circumference side-attachment-wall side 9 of the permanent magnet embedding hole 5 by the elastic member 12 and the permanent magnet type reluctance mold dynamo-electric machine of the gestalt of implementation of the above 4th is fixed, while a permanent magnet 6 is stabilized and dependability improves -- a rotator 3 -- a high-speed revolution is attained more.
[0076] (The gestalt of the 5th operation: Correspond to claims 8, 9, and 10)
(Configuration) Drawing 6 is the direction expanded sectional view of a path of a rotator showing the gestalt of operation of the 5th of the permanent magnet type reluctance mold dynamo-electric machine of this invention.
[0077] That is, as shown in drawing 6 , gestalten of this operation are consisted of by the rotor core 4 between the permanent magnet embedding hole 5 and the nonmagnetic section 8 so that notching or the elastic section 13 cut and according to lifting processing may be formed, the elastic section 13 may turn a permanent magnet 6 to the inner circumference side-attachment-wall side 9 in the permanent magnet embedding hole 5 and it may always press.
[0078] Moreover, the permanent magnet type reluctance mold dynamo-electric machine of the gestalt of this operation is constituted as the inside diameter d of an iron core (rotator) 4 is in 25% - 55% of range of a dimension dout.
[0079] That is, drawing 7 is property drawing having shown the relation of the maximum stress value sigma (axis of ordinate) within the iron core 4 over the inside diameter d of the iron core 4 at the time of the revolution of the rotator 3 shown in drawing 6 (axis of abscissa).
[0080] After showing a once small value, the maximum stress value alpha within an iron core 4 presents the property which becomes large one by one bordering on the minimum value in on the way (dalpha), as a dynamo-electric machine is shown in drawing 7 and the inside diameter d of an iron core (rotator) 4 becomes large one by one to d1 ->d alpha->d 2. Then, inside diameter dalpha from which, as for invention of the gestalt of this operation, the maximum stress value alpha within an iron core 4 serves as min is made to the rotor core outer diameter dout paying attention to existing in 25% - 55% of within the limits.
[0081] Therefore, to an outer diameter dout, by setting up an inside diameter d so that it may be set to abbreviation dalpha from which the maximum stress value alpha serves as min, the stress within the iron core 4 by the revolution centrifugal force is mitigated, and the inside diameter d of a rotor core 4 can obtain the rigid high rotator 3 still more preferably 25% - 55% of within the limits.
[0082] In addition, if it becomes that from which each configuration of a permanent magnet 6 and the permanent magnet embedding hole 5, the inclination of arrangement, etc. differ, optimal inside diameter dalpha from which the stress value within a rotor core 4 serves as min will also change a little. However, optimal inside diameter dalpha exists in 25% - 55% of within the limits too to the iron core outer diameter dout.
[0083] Therefore, the permanent magnet type reluctance mold dynamo-electric machine of the gestalt of this operation The permanent magnet 6 in the permanent magnet embedding hole 5 is added to the magnetic-attraction force of self. In response to energization by the elastic section 13, it is pressed by the inner circumference side-attachment-wall side 9, and is fixed to it, and the inside diameter d of a rotor core 4 is further set as optimal inside diameter dalpha from which the stress value within a rotor core 4 serves as min still more preferably to an outer diameter dout at 25% - 55% of within the limits, and it is constituted.
[0084] In addition, although the elastic section 13 was formed with the gestalt of this operation by notching which met in the direction of a path of an iron core (rotator) 4, or the end lifting, of course, it can also prepare along the direction of a revolving shaft.
[0085] (Operation) According to the permanent magnet type reluctance mold dynamo-electric machine constituted as mentioned above, the elastic section 13 is formed in the rotor core 4 between the permanent magnet embedding hole 5 and the nonmagnetic section 8, a permanent magnet 6 being energized, it is fixed to the inner circumference side-attachment-wall side 9 of the permanent magnet embedding hole 5 of a permanent magnet 6, and the elastic section 13 is stabilized.
[0086] Moreover, since it was constituted as the inside diameter d of a rotor core 4 was in 25% - 55% of within the limits to a dimension dout, the stress within the rotor core 4 accompanying a revolution can be stopped to the minimum.
[0087] (Effectiveness) As mentioned above, since a permanent magnet 6 is pushed against the inner circumference side-attachment-wall side 9 of the permanent magnet embedding hole 5 by the elastic section 13 of a rotor core 4, it is conjointly fixed firmly with the magnetic-attraction force of self, the high-speed revolution of a permanent magnet 6 is attained, and dependability of the permanent magnet type reluctance mold dynamo-electric machine of the gestalt of the 5th operation also improves by it.
[0088] Moreover, since mere notching or mere cutting, and it being formed of lifting processing and inserting elastic members, such as a spring, to an iron core 4 cannot be found, the elastic section 13 can be manufactured, without increasing components mark.
[0089] moreover -- since according to the gestalt of this operation it formed so that the inside diameter d of a rotor core 4 might serve as 25% - 55% of range of a dimension dout, it is possible to hold down the stress value over the centrifugal force within a rotor core 4 to the minimum -- becoming -- the improvement in dependability -- simultaneously, a high-speed revolution and high power are more realizable.
[0090] (The gestalt of the 6th operation: Correspond to claims 11 and 12)
(Configuration) The direction sectional view of a path in which drawing 8 shows the gestalt of operation of the 6th of the permanent magnet type reluctance mold dynamo-electric machine of this invention, the direction expanded sectional view of a path of the rotator which shows drawing 9 to drawing 8 , and drawing 10 are the perspective views of the permanent magnet shown in drawing 8 .
[0091] As the configuration of the permanent magnet 14 inserted in the permanent magnet embedding hole 5 of a rotor core 4 is expanded to drawing 10 and shown, the area of the field (a graphic display cross section) which intersects perpendicularly in trapezoidal shape 15, i.e., the magnetization direction shown with a sign 16, changes towards the magnetization direction towards the magnetization direction 15, and the permanent magnet type

reluctance mold dynamo-electric machine of the gestalt of this operation is constituted so that it may become small one by one.
[0092] Moreover, in the configuration of the permanent magnet embedding hole 5 where the permanent magnet 14 was inserted, as shown in drawing 8 and drawing 9 , the height of a couple is formed towards the inside from the inner circumference side-attachment-wall side 9 of a rotor core 4, and the processing configuration is carried out so that the pars basilaris ossis occipitalis of the trapezoidal shape of a permanent magnet 14 may be held and it may fix between the heights of the couple.
[0093] Therefore, with the gestalt of this operation, it can equip with a permanent magnet 14 in the permanent magnet embedding hole 5 by insertion actuation of a between [the heights of the inner circumference side-attachment-wall side 9].
[0094] (Operation) As mentioned above, since the permanent magnet type reluctance mold dynamo-electric machine of the gestalt of this operation gave directivity so that area (horizontal area) might change the configuration of a permanent magnet 14 in the magnetization direction 15, authorized personnel can identify the magnetization direction 15 of a permanent magnet 6 visually.
[0095] (Effectiveness) Therefore, since according to the gestalt of the 6th operation the configuration was changed from the above 1st along the magnetization direction 15 while a permanent magnet 6 was firmly fixed by the magnetic-attraction force of self like the gestalt of each 5th operation, nonconformity with which authorized personnel are mistaken in the direction of a permanent magnet 6, and equip in a rotor core 4 is avoided, and can raise manufacture effectiveness.
[0096] In addition, although explained with the gestalt of each implementation of the above-mentioned explanation that dynamo-electric machines were four poles, it cannot be overemphasized that it is not limited to a pole by four poles.
[0097] Above, like explanation, since a permanent magnet is fixed to the inner circumference side-attachment-wall side of a permanent magnet embedding hole according to the magnetic-attraction force of self according to the permanent magnet type reluctance mold dynamo-electric machine of this invention, the stress within the rotor core accompanying a revolution is reduced, can realize high-speed revolution and high power, and can acquire remarkable effectiveness on the occasion of practical use.
[0098]
[Effect of the Invention] According to invention given in claims 1-3, with the nonmagnetic section, it can be fixed to the wall surface of the permanent magnet embedding hole of an opposite hand, the centrifugal force of the permanent magnet accompanying the revolution of a rotator can mitigate the stress in a rotator, and a permanent magnet can avoid breakage on a rotator.
[0099] According to invention according to claim 4 or 5, in the magnetic-attraction force of a permanent magnet, since the difference was established among the both ends of the magnetization direction, breakage on a rotator is avoidable like invention of claims 1-3.
[0100] According to invention according to claim 6, in addition to an effect of the invention according to claim 3, firmer immobilization of a permanent magnet is attained by existence of a magnetic member.
[0101] In addition to an effect of the invention according to claim 1; also in invention according to claim 7 or 8, firmer immobilization of a permanent magnet is attained by existence of an elastic member or the elastic section.
[0102] According to invention according to claim 9 or 10, the stress within the iron core accompanying the revolution of the rotator itself can be mitigated, and the dynamo-electric machine of a high-speed revolution can be realized more.
[0103] According to invention according to claim 11 or 12, since the directivity to the magnetization direction was given to the configuration of a permanent magnet, wearing into an iron core can be ensured [easily and], and manufacture effectiveness can be raised.

[Translation done.]

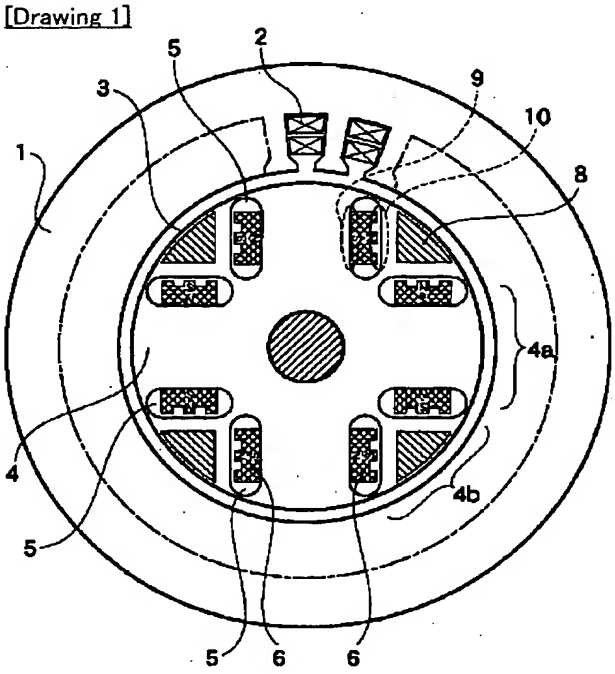
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the direction sectional view of a path of the permanent magnet type reluctance mold dynamo-electric machine concerning the gestalt of operation of the 1st of this invention.
[Drawing 2] It is the direction expanded sectional view of a path of the rotator shown in drawing 1 .
[Drawing 3] It is the direction expanded sectional view of the diameter of a rotator of the permanent magnet type reluctance mold dynamo-electric machine concerning the gestalt of operation of the 2nd of this invention.
[Drawing 4] It is the direction expanded sectional view of the diameter of a rotator of the permanent magnet type reluctance mold dynamo-electric machine concerning the gestalt of operation of the 3rd of this invention.
[Drawing 5] It is the direction expanded sectional view of the diameter of a rotator of the permanent magnet type reluctance mold dynamo-electric machine concerning the gestalt of operation of the 4th of this invention.
[Drawing 6] It is the direction expanded sectional view of the diameter of a rotator of the permanent magnet type reluctance mold dynamo-electric machine concerning the gestalt of operation of the 5th of this invention.
[Drawing 7] It is property drawing showing the relation between the rotor core inside diameter of the permanent magnet type reluctance mold dynamo-electric machine shown in drawing 6 , and the maximum stress value within a rotor core.
[Drawing 8] It is the direction sectional view of a path of the rotator of the permanent magnet type reluctance mold dynamo-electric machine concerning the gestalt of operation of the 6th of this invention.
[Drawing 9] It is the direction expanded sectional view of a path of the rotator shown in drawing 8 .
[Drawing 10] It is the perspective view of the permanent magnet shown in drawing 9 .
[Drawing 11] It is the direction sectional view of a path of the conventional permanent magnet type reluctance mold dynamo-electric machine.
[Drawing 12] It is the direction sectional view of a path having shown the flow of magnetic-flux phid of the component of a direction in alignment with the magnetic pole shaft of the rotor core by the armature current of d shaft of the permanent magnet type reluctance mold dynamo-electric machine shown in drawing 11 .
[Drawing 13] It is the direction sectional view of a path having shown the flow of magnetic-flux phiq of the component of a direction in alignment with the shaft of the direction of a path centering on 4between magnetic poles b by the armature current of q shaft of the permanent magnet type reluctance mold dynamo-electric machine shown in drawing 11 .
[Drawing 14] It is the direction sectional view of a path having shown the flow of the magnetic flux which the permanent magnet of the permanent magnet type reluctance mold dynamo-electric machine shown in drawing 11 generates.
[Drawing 15] It is the direction expanded sectional view of a path of a rotator having shown the flow of the magnetic flux which the permanent magnet of the permanent magnet type reluctance mold dynamo-electric machine shown in drawing 11 generates.
[Description of Notations]
1 ... Stator
2 ... Armature coil
3 ... Rotator
4 ... (rotator) Iron core
5 ... Permanent magnet embedding hole
6 ... Permanent magnet
7 14 ... The magnetic section
8 ... Nonmagnetic section
9 ... Inner circumference side-attachment-wall side of a permanent magnet embedding hole
10 ... Periphery side-attachment-wall side of a permanent magnet embedding hole
11 ... Magnetic member
12 ... Elastic member
13 ... Elastic section
18 ... Periphery side thin-walled part
19 ... Bridge thin-walled part
4a ... Magnetic pole section
4b ... Between magnetic poles

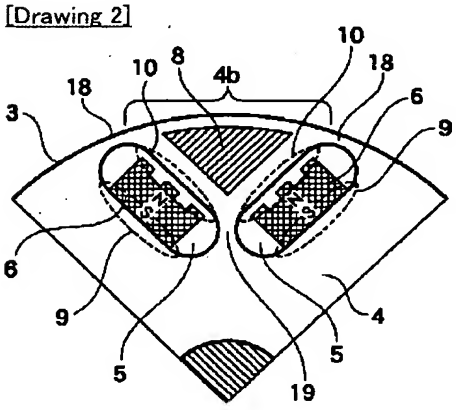
[Translation done.]

DRAWINGS

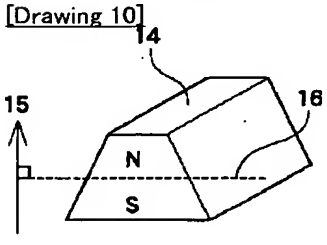
[Drawing 1]



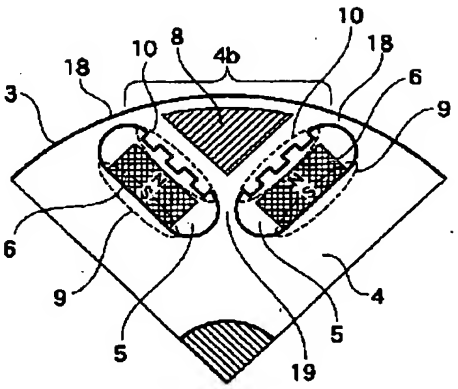
[Drawing 2]



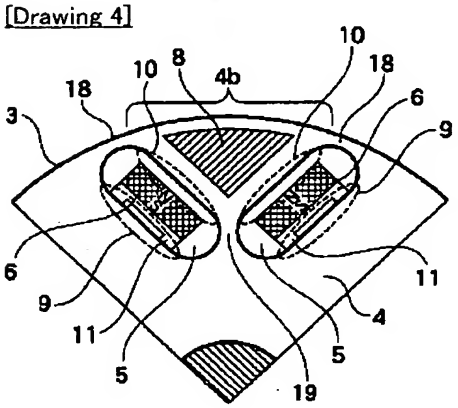
[Drawing 10]



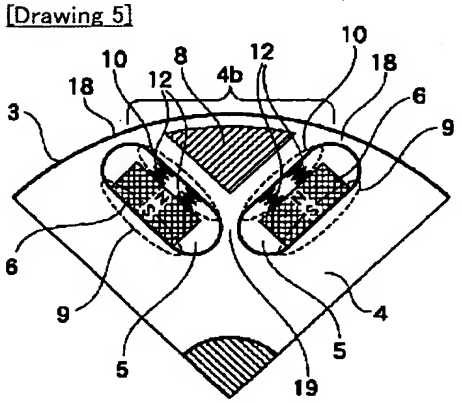
[Drawing 3]



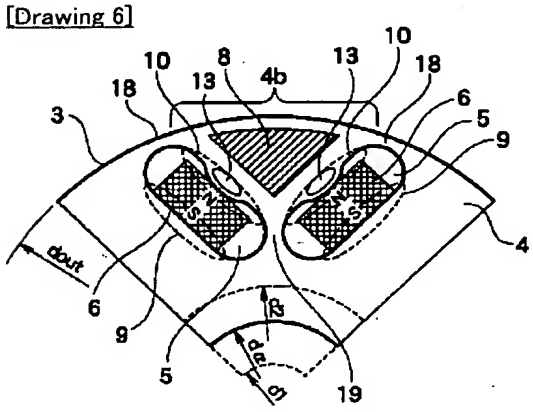
[Drawing 4]



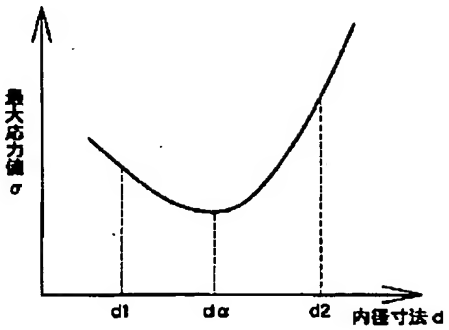
[Drawing 5]



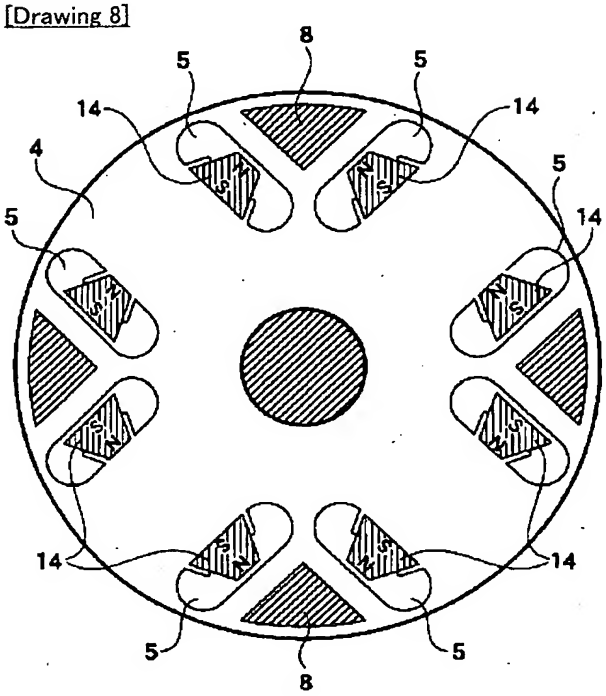
[Drawing 6]



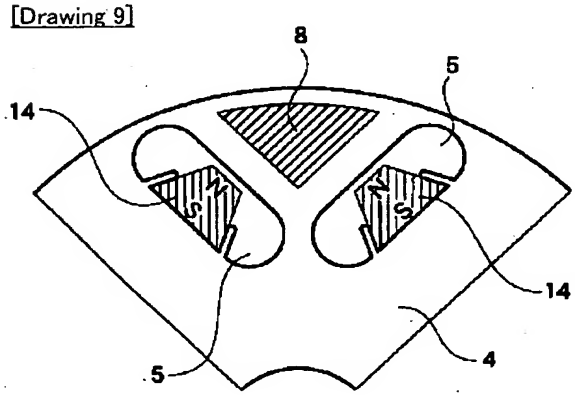
[Drawing 7]



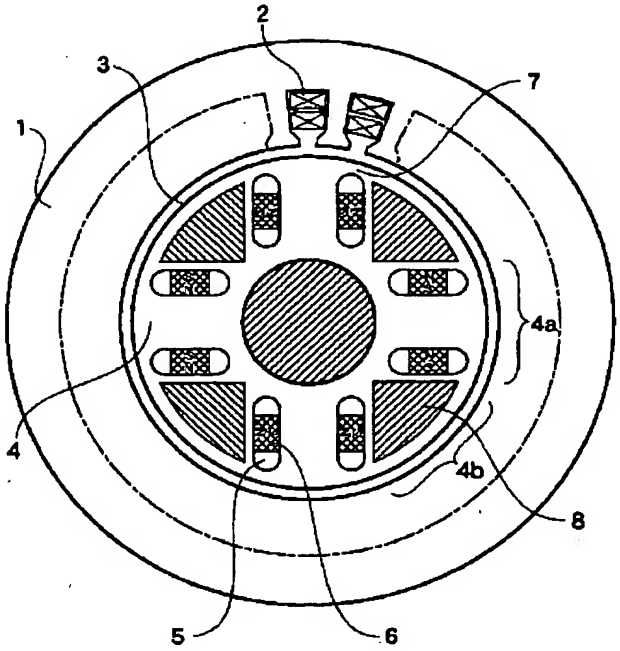
[Drawing 8]



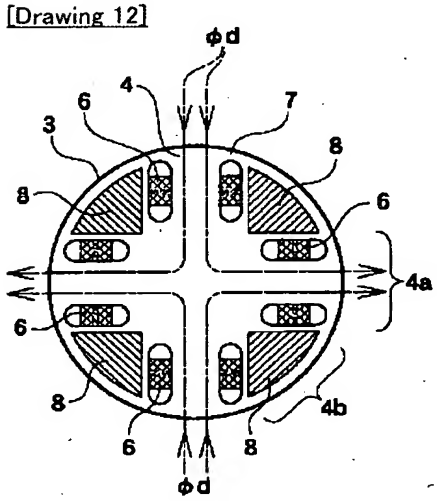
[Drawing 9]



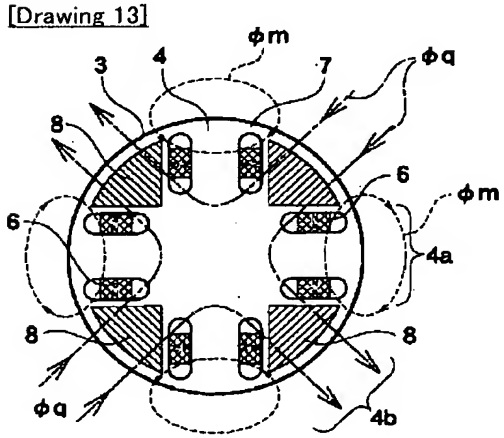
[Drawing 11]



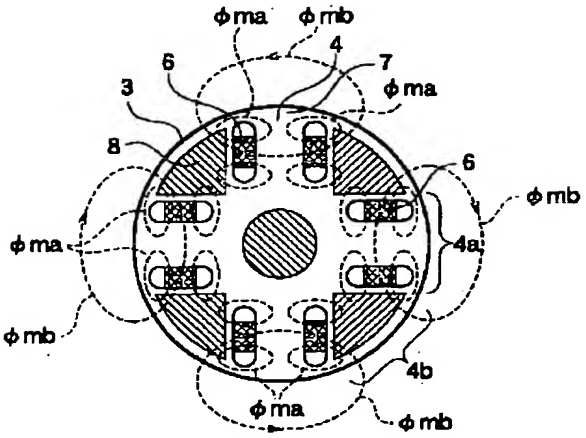
[Drawing 12]



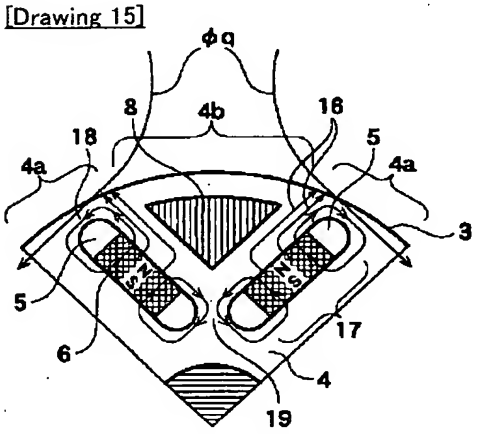
[Drawing 13]



[Drawing 14]



[Drawing 15]



[Translation done.]